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Haber et al.

[11] **4,157,805**

[45] **Jun. 12, 1979**

[54] **MOLDING APPARATUS FOR A COMPOSITE BILLIARD BALL**

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[51] **Int. Cl.**[2] **B29C 1/00**

[52] **U.S. Cl.** ..... **249/91**; 249/95; 249/96; 249/105; 249/168; 273/59 R

[58] **Field of Search** ..... 273/59 R, 63 C, 63 G; 249/95, 96, 160, 168, 91, 105; 264/275

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,068,007	12/1962	Satchell	273/63 G
3,202,742	8/1965	Bachelder et al.	273/63 G
3,270,108	8/1966	Randolph	273/63 G
3,344,468	10/1967	Moslo	264/75

FOREIGN PATENT DOCUMENTS

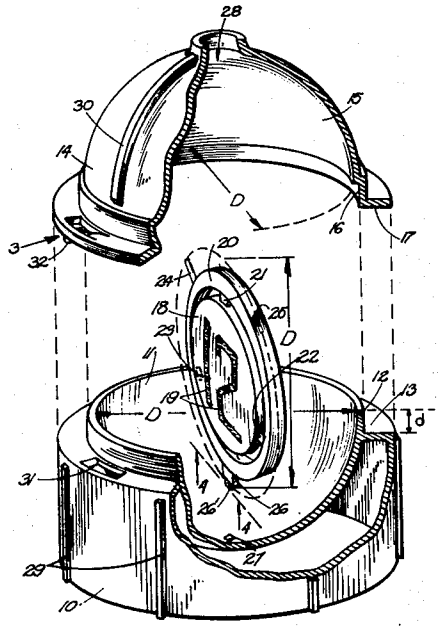
688525	8/1930	France	273/59 R

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[57] **ABSTRACT**

An example of the shock resistant transparent polymer sphere is a billiard or pool ball. The molding apparatus includes lower and upper mold halves defining juxtaposed concave hemispherical surfaces to define a spherical mold cavity with a top fill opening on the upper mold half. Interlocking of the mold halves together is accomplished by tongue and window structures circumferentially spaced about the meeting points of the two halves at 120°. A holder in the form of an annular ring is provided for supporting a central disc provided with a symbol on each of its opposite faces. The design is such that the ring when positioned in the spherical cavity defined by the mold halves supports the disc with its center coincident with the center of the spherical cavity. The molded sphere is made by a single pouring operation of resin through the fill opening, the disc and ring being encapsulated within the sphere. The composition of the resulting product is such that a bonding takes place between the disc, ring and resin material for the sphere resulting in a final sphere in which shock is absorbed by the disc, supporting ring, ink utilized in forming the symbol on the opposite faces of the disc as well as the resin as though the entire sphere were homogeneous throughout.

5 Claims, 5 Drawing Figures



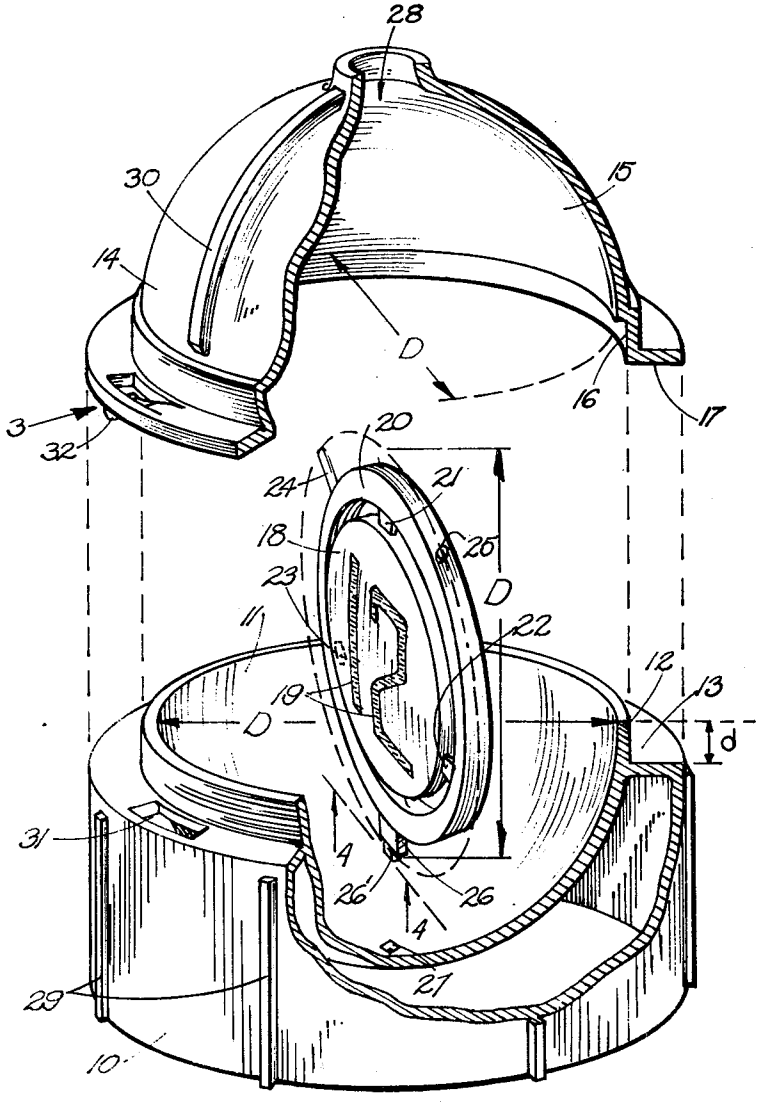


fig 1

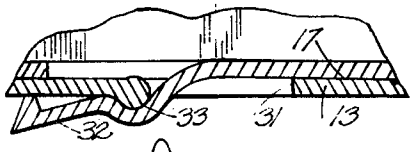


fig 3

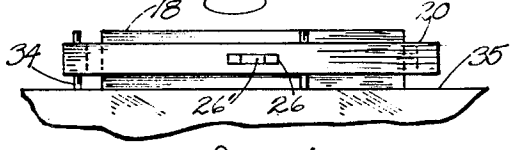


fig 4

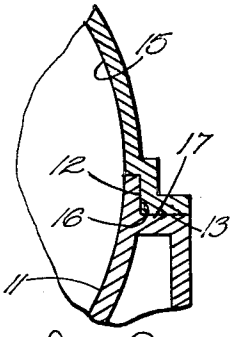


fig 2

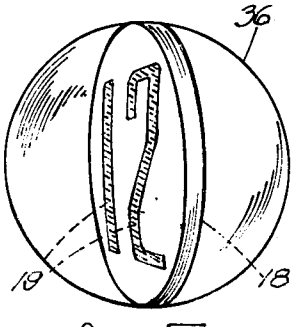


fig 5

MOLDING APPARATUS FOR A COMPOSITE BILLIARD BALL

This invention relates to a molding apparatus, for providing shock resistant transparent polymer spheres useful, by way of example, as pool or billiard balls.

BACKGROUND OF THE INVENTION

Spherical objects utilized in games such as pool or billiards are normally homogeneous throughout so that the shock of impact will be thoroughly, uniformly absorbed throughout the entire mass of the ball. In the case of a pool ball, a number designation identifying the ball is provided on one or more surface portions of the ball, the balls themselves normally being opaque.

A very attractive type of pool ball would result if a transparent material could be used in molding the ball. In such instances, however, provision of a designating numeral on the surface would interrupt the transparent feature of the ball and it would be preferable if the designating numeral could someway be incorporated or encapsulated within the ball.

It is already known to provide a transparent bowling ball encapsulating geometric designs to enhance and provide a novel appearance for the bowling ball. In this respect, reference is had to U.S. Pat. No. 3,207,514 to Vickery claiming such a structure. However, so far as we are aware, there has never heretofore been produced a transparent pool or billiard ball incorporating an appropriate number designation except in one instance wherein a transparent pool ball was constructed. Nevertheless, in this instance effective bonding between the incorporated numeral carrier in the sphere and the sphere material itself as well as the ink or other means for providing a numeral or symbol has not always been assured. As a consequence, shattering of the ball along cleavage planes where improper bonding occurs can result. Moreover, surface deterioration and imperfections are difficult to avoid.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

Bearing the foregoing in mind, the present invention contemplates an improved molding apparatus, for providing shock resistant transparent polymer spheres such as pool balls and in its preferred embodiment is specifically concerned with the formation of transparent pool balls encapsulating an appropriate opaque disc having a numeral designation on its opposite faces to identify the ball.

Essentially, this improved invention, as a consequence of the molding apparatus, employed provides a vastly improved pool ball wherein impact shocks are absorbed by the resin of the ball as well as the encapsulated materials in the ball all the same as though a homogeneous ball were provided. Further, the molding apparatus assures bonding of the encapsulated portions with the resin of the sphere in such a manner as to minimize the risk of any cleavage planes which would result in shattering of the ball upon impact.

BRIEF DESCRIPTION OF THE DRAWINGS

A complete understanding of this invention as well as many other features and advantages resulting therefrom will be had by now referring to the accompanying drawings in which:

FIG. **1** is an exploded perspective view with portions cut away of a molding apparatus in accord with this invention;

FIG. **2** is a fragmentary cross section of a portion of the structure of FIG. **1** when in assembled relationship;

FIG. **3** is another fragmentary cross section of the assembled structure of FIG. **1** looking in the direction of the arrow **3**;

FIG. **4** is a side elevational view of a disc-ring assembly shown in FIG. **1** for encapsulation; and,

FIG. **5** is a perspective view of a finished pool ball product formed in accord with the apparatus of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, the molding apparatus itself includes a lower mold half **10** defining an upwardly facing concave hemispherical surface **11**. The upper exterior marginal wall of the surface **11** is cylindrical as shown at **12** for a given vertical distance downwardly, this surface thence extending laterally outwardly to define a flat annular upwardly facing shoulder **13**.

An upper mold half **14** defines a downwardly facing concave hemispherical surface **15**. The lower interior wall of this surface has an increased diameter portion at the lower edge of said downwardly facing concave hemispherical surface defining an interior cylindrical wall **16** extending downwardly beyond the edge the same given vertical distance as the exterior wall **12** of the lower mold half. The interior cylindrical wall **16** thence extends laterally to define a flat annular downwardly facing shoulder **17** for seating on the upwardly facing shoulder **13** when the external marginal wall **12** is received in the internal cylindrical wall **16** so that the upwardly facing and downwardly facing concave hemispherical surfaces are juxtaposed to define a spherical cavity.

Referring to the central portion of FIG. **1**, there is shown a disc **18** provided with a symbol **19** on each of its opposite faces. In the embodiment disclosed, this symbol constitutes the numeral **12** and serves to identify a pool ball within which the disc will ultimately be encapsulated.

The disc **18** is diametrically held in the spherical cavity of the mold so that its center coincides with the center of the spherical cavity. Towards this end, there is provided a holder for the disc in the form of an annular ring **20** having a plurality of lugs **21**, **22** and **23** extending radially inwardly equal distances to engage the periphery of the disc **18** at equal circumferentially spaced points. The disc is thus held inside the ring in substantially coplanar relationship.

The exterior of the ring includes at least two locating pins **24** and **25** extending radially outwardly, and a centering projection **26** having an end portion **26'** shown at the bottom of the ring **20**. The pins and centering projection are spaced at 120°, the bottom-most point on the upwardly facing hemispherical surface having a hole **27** receiving the end portion **26'** of the centering projection **26**.

The diameter of the holder as measured out to the tips of the pins and the start of the end portion of the centering projection **26** is indicated at D and is substantially the same as the diameter of the hemispherical surface also designated by the same letter D in FIG. **1**.

With the foregoing arrangement, the disc **18** will necessarily be held in a diametric position within the

spherical cavity defined by the juxtaposed hemispherical surfaces **11** and **15** of the lower and upper mold halves respectively, the centering projection **26** having its end portion **26'** received in the central bottom opening **27** of the lower mold half **11** and the locating pins **24** and **25** touching lightly the downwardly facing hemispherical surface **15**.

The top center of the upper mold half **14** includes a fill opening **28** for introducing molding material. The exterior walls of the lower and upper mold halves further may be provided with gripping lands or ribs as indicated at **29** and **30** respectively. In this respect, the flat upwardly facing annular shoulder **13** and the flat downwardly facing annular shoulder **17** include cooperating fastening means for holding the mold halves together, this fastening means being responsive to relative twisting of one mold half with respect to the other. The provision of the lands or rib on the exterior of the mold halves facilitates this manual twisting to lock the halves together or to release the halves.

The foregoing mentioned cooperating fastening means in the specific embodiment shown includes three windows on the flat upwardly facing annular shoulder **13** spaced 120° from each other. Only one of these windows is visible as indicated at **31** in FIG. **1**. The flat downwardly facing annular shoulder **17** in turn is provided with three flexible tongues extending at an acute angle to the shoulder receivable in the windows, when the upper mold is rotated in the direction of extension of the tongues relative to the lower mold half. Only one of these tongues is visible at **32** in FIG. **3**.

The foregoing locking feature can better be understood by now referring to FIGS. **2** and **3**. FIG. **2** illustrates the seating of the lower and upper annular shoulders **13** and **17** and it will be understood that when positioning the upper mold half on the lower mold half, the tongues **32** are indexed to enter the windows **31**.

FIG. **3** illustrates the relative positions of the tongue and windows after the same have been received through the window and the upper mold half twisted relative to the lower mold half in a clockwise direction as viewed from the top. It will be evident that the tongue **32** has been locked under an edge of the window **31**. In this respect, curved cooperating camming surfaces are provided as indicated at **33** for holding the tongues in their final positions within the windows. Thus, the edge portion of the window **31** under which the tongue **32** slides is provided with an enlarged rounded cross section as shown in FIG. **3**, the tongue **32** itself having a depressed or curved portion for receiving this rounded portion when the tongue is wholly disposed beneath the edge of the window thus providing an indexing or locking of the mold halves together. When the upper mold half is to be removed from the lower mold half, a twist in the opposite direction will result in a camming down of the tongue **32** by the rounded portion **33** so that release of the tongue through the window can take place.

In the description of the disc **18** and holding ring **20** in FIG. **1**, it will be recalled that the disc **18** was described as being substantially coplanar with the ring **20**. To effect this coplanar relationship, it is necessary that the medial plane of the disc **18** coincide with the medial plane of the ring **20**. The ring **20** itself has a thickness which is less than the thickness of the disc **18** and thus for proper centering, the opposite faces or surfaces of the disc **18** must extend equal distances beyond the opposite faces of the annular ring **20**.

To assure the above described proper positioning of the disc relative to the ring, reference is had to FIG. **4** wherein it will be noted that the ring includes axially extending nubs from its opposite flat surfaces, one such nub being indicated at **34** in FIG. **4**. These nubs terminate in the plane of the opposite surfaces of the disc when the disc is centered in the ring. Accordingly, proper axial centering of the disc in the ring can be effected by engaging a flat surface indicated at **35** in FIG. **4** with one surface of the disc and the corresponding ends of the nubs **34**.

The method of manufacturing a shock resistant transparent polymer sphere such as a pool ball with a disc having a symbol inked on each of its opposite faces diametrically incorporated in the sphere with the center of gravity of the disc coincident with the center of gravity of the sphere utilizing the molding apparatus of FIGS. **1–4** will now be described.

First, a mold is provided defining a spherical cavity with a single fill opening at its top. This spherical cavity may be provided by the mold halves shown in FIG. **1**.

A given transparent polyester resin in uncured liquid form is then provided preparatory to pouring into the mold. One type of polyester resin is identified as "Clear Cast" manufactured by Fiberlay, Inc. of Seattle, Washington. This resin is preferably mixed with an appropriate catalyst to harden the resin after pouring. Such a catalyst is identified by "P-102" manufactured by the same company as "Clear Cast". Additionally, a "surface seal" may be added to the mixture to avoid a tacky surface upon hardening. The resin involved has a given index of refraction and a given density after curing.

The method then includes the steps of providing an opaque disc such as the disc **18** of FIG. **1** of thermoplastic material having substantially the same density as the above referred-to given density but constituting a plastic different from the polyester resin. The material of the disc has the characteristics of mechanically and chemically bonding with the resin without any surface deterioration. Further, this material has the property of swelling slightly on extended contact with the polyester resin.

A holder corresponding to the annular ring **20** described in FIG. **1** is then provided and constitutes a thermoplastic material which will mechanically and chemically bond with the polyester resin. The thermoplastic material of the ring has the same index of refraction, transparency, Rockwell hardness and surface finishing characteristics as the polyester resin.

In order to provide the symbol or numeral designation on the opposite faces of the disc, there is provided an ink constituting a polyester and thermoplastic alloy which further functions as a catalyst for the polyester resin and will bond to both the disc and the resin. This ink is silk-screened on each of the opposite faces of the disc by an appropriate mask defining the numeral **12** in the particular example set forth.

The disc is positioned in central coplanar relationship in the ring with the ring lugs described in FIG. **1** engaging the periphery of the disc at equal circumferentially spaced points to hold it centered and provide a disc-ring assembly.

This disc-ring assembly is then positioned in the spherical cavity of the mold so that the center of the disc coincides with the center of the spherical cavity.

Next, the polyester resin is poured into the fill opening **28** to completely fill the cavity and thereby encapsulate this disc-ring assembly. Care must be taken to pour

the resin in carefully and slowly to avoid any possible entrapment of air bubbles. Essentially, however, there is only necessary a single pouring operation.

After the resin has cured with the disc-ring assembly encapsulated therein, the ring is substantially invisible. The cured sphere can then be removed from the mold by separating the mold halves in the event a mold of the type described in FIG. **1** is employed.

Final steps of the method involve polishing the surface of the resulting sphere to provide the completed transparent polymer sphere.

It will be recalled that a characteristic of the thermoplastic material comprising the disc is that it swells slightly upon extended contact with the polyester resin. Bonding of the disc and ink to each other and to the polyester resin thus results in an embossed characteristic for the symbols, the uncovered surface portions of the disc swelling slightly. The further bonding of the ring with the disc and resin results in a final sphere in which shock impacts are absorbed by the disc, ink and ring as well as the resin as though the entire sphere were homogeneous throughout.

The foregoing bonding characteristics of all of the components making up the finalized pool ball minimize any risk of shattering of the ball upon impact because of the uniform absorption of shock by the bonded constituents. In other words, there are no "cleavage planes" which could cause such shattering. Moreover, the bonding of the disc with the polyester resin is effected without any surface deterioration and a minimization of any visible imperfections.

FIG. **5** illustrates the final product composition which, in the particular embodiment described, constitutes a pool ball identified by the numeral **12**. While the actual diameter of the disc **18** is less than the outside diameter of the completed sphere, the disc will nevertheless appear to be of the same diameter because of the optical magnification accorded by the hermispherical clear resin portions on opposite sides of the disc.

The resulting transparent pool ball has many advantages in actual play. The rotational axis, for example, can immediately be identified by observing the rotation of the disc when the ball is impelled by a cue ball. This latter feature is important in controlling the amount of "English" applied to the ball.

The weight of the ball illustrated in FIG. **5** is 117 grams plus or minus three grams. This weight or mass is less than that of a conventional pool ball but results in a more "lively" action of the ball; for example, better rebound and less moment of inertia. The diameter of the ball corresponds to conventional pool balls and is equal to 57 millimeters plus or minus 1 millimeter.

From all of the foregoing, it will be appreciated that the present invention provides a greatly improved shock resistant transparent polymer sphere molding apparatus, method and product composition particularly useful in the provision of pool balls.

We claim:

1. A molding apparatus for manufacturing a shock resistant transparent polymer sphere in which a disc having a symbol on each of its opposite faces is diametrically incorporated in the sphere with the center of gravity of the disc coincident with the center of gravity of the sphere, comprising, in combination:

(a) a lower mold half defining an upwardly facing concave hemispherical surface, the upper exterior marginal wall of said lower mold half being cylindrical for a given vertical distance downwardly, thence extending laterally outwardly to define a flat annular upwardly facing shoulder;

(b) an upper mold half defining a downwardly facing concave hemispherical surface, the lower interior wall of said upper mold half having an increased diameter portion at the lower edge of said downwardly facing concave hemispherical surface defining an interior cylindrical wall extending downwardly beyond said edge said given vertical distance and thence laterally outwardly to define a flat annular downwardly facing shoulder for seating on said upwardly facing shoulder when said exterior marginal wall is received in said interior cylindrical wall so that the upwardly facing and downwardly facing concave hemispherical surfaces are juxtaposed to define a spherical cavity, said flat upwardly facing annular shoulder and said flat downwardly facing annular shoulder including cooperating fastening means for holding the mold halves together; and,

(c) a holder for said disc in the form of an annular ring having a plurality of lugs extending radially inwardly equal distances to engage the periphery of said disc at equal circumferentially spaced points to support said disc inside said ring in substantially coplanar relationship, the exterior of said ring having at least two locating pins extending radially outwardly, and a centering projection, said pins and centering projection being circumferentially spaced, the bottom-most point on said upwardly facing hemispherical surface having a hole receiving an end portion of said centering projection, and the top-most point on said downwardly facing hemispherical surface having a fill opening for introducing molding material, the diameter of said holder as measured out to the tips of said pins and the start of said end portion of said centering projection being substantially the same as the diameter of the hemispherical surfaces, whereby a shock resistant transparent polymer sphere incorporating a disc can be manufactured in a single mold material pouring operation.

2. A molding apparatus according to claim **1**, in which said cooperating fastening means include three windows on said flat upwardly facing annular shoulder spaced 120°, said flat downwardly facing annular shoulder having three flexible tongues extending at an acute angle to the surface of said downwardly facing annular shoulder receivable in said windows when said upper mold half is rotated in the direction of extension of the tongues relative to the lower mold half to thereby lock the mold halves together.

3. A molding apparatus according to claim **1**, in which said ring includes axially extending nubs terminating at the plane of the surfaces of said disc when centered in said ring so that proper axial centering of said disc in said ring can be effected by engaging a flat surface with one surface of said disc and the ends of the nubs.

4. A molding apparatus according to claim **1**, in which the lower and upper exterior surfaces of said lower and upper mold halves respectively include gripping lands to facilitate manual rotation of one mold half relative to the other.

5. A molding apparatus according to claim **2**, in which an edge portion of said windows and a top surface portion of said tongues include cooperating curved surfaces providing a camming and locking action for said mold halves when relatively rotated to cause said tongues to be completely received in said windows.

* * * * *